United States
Environmental Protection
Agency

Office of Water (4503F)
Washington, DC 20460
www.epa.gov/ow

EPA 841-D-01-003
August 1, 2001

The National Costs of the Total Maximum Daily Load Program (Draft Report)

DRAFT FOR REVIEW AND COMMENT

The National Costs of the Total Maximum Daily Load Program

Office of Water
U.S. Environmental Protection Agency

August 1, 2001

TABLE OF CONTENTS

SUPPORTING REPORTS:

Environomics and Tetra Tech, Inc., *The National Costs to Develop TMDLs*, prepared for the U.S. EPA, Office of Wetlands, Oceans and Watersheds, draft July, 2001

Environomics and Tetra Tech, Inc., *The National Costs to Implement TMDLs*, prepared for the U.S. EPA, Office of Wetlands, Oceans and Watersheds, draft July, 2001

Executive Summary

Most Americans agree that the quality of the Nation's rivers, lakes and coastal waters has improved dramatically over the past 30 years. This remarkable improvement in the Nation's rivers, lakes, and coastal waters was led by governments at the federal, state, tribal and local level but could not have been accomplished without the hard work of citizens and the sustained financial commitment of the private sector.

At the same time, there is a recognition that some water pollution problems remain to be addressed. In 1998, states reported nearly 22,000 individual water bodies including river and stream segments, lakes, and estuaries that do not attain state adopted water quality standards. These impaired waters include 300,000 miles of rivers and coastal shoreline and approximately 5 million acres of lakes, representing about one-third of the length/acreage of all waters in the U.S. whose quality has been assessed, and about 10 % of all the waters Nationwide.

Defining policies and programs that sustain the quality of water resources and restoring the health of those waters that are impaired is a complex problem. The Clean Water Act provides a sturdy foundation of core water quality programs, but the implementation of these programs by the Environmental Protection Agency (EPA), states, tribes, and others is the subject of controversy. Over the past several years, there has been considerable debate over the best approach to restoring impaired waters and the costs of various approaches to this task. In response to this debate, Congress directed the EPA to study the costs of implementing the Total Maximum Daily Load or "TMDL" program.

Key Findings

This Report responds to Congress' request for information on the costs of implementing pollution control measures to develop and implement TMDLs. Key findings of the Report are --

1) Costs to Pollutant Sources to Implement the TMDL Program Range from Under $1 Billion/Year to $4.3 Billion/Year Depending on Efficiency of TMDLs

- The cost of measures to implement TMDLs for impaired waters now identified by states is estimated to be between $900 million and $3.2 billion per year if the problem is approached through the implementation of TMDLs that seek the lowest cost alternatives among all sources of the impairments (see Table ES-I).

- If the TMDL program was implemented based on an assessment of the reduction needed for the water body and an allocation that includes all sources of impairment, without strict attention to the most cost-effective allocations, costs would be expected to rise to between $1 billion and $3.4 billion per year.

– In the event that the impaired waters were addressed using a least flexible TMDL scenario costs might rise to as high as $1.9 billion and $4.3 billion per year. Under this unlikely scenario, regardless of the individual contributions of different sources, states would simply tighten discharge permits and other national requirements through a uniform and inflexible approach. This scenario would not benefit from site-specific tailoring to local conditions that should result from development of a more careful allocation.

– When a moderately cost-effective TMDL program, which looks for readily available cost effective solutions, is used to allocate pollution reduction responsibilities, the costs for *both* point and nonpoint sources are reduced.

– The nonpoint pollution control measures expected to be implemented under each option would generate some partly offsetting cost savings (e.g. by reducing the frequency of application and the amount of fertilizer used), but these specific savings could not be calculated.

Table ES - 1
Estimated Costs for Pollutant Sources to Implement TMDLs

Type of Source	Annual Costs (2000 $ in millions)		
	Least Flexible TMDL Program	**Moderately Cost-effective TMDL Program**	**More Cost-Effective TMDL Program**
Point sources	1,082 - 2,178	812 - 1,634	625 - 1,321
Nonpoint sources	783 - 2,162	234 - 1,791	281 - 1,869
Total implementation costs	**1,865 - 4,340**	**1,046 - 3,425**	**906 - 3,190**
Potential savings for nonpoint sources	undetermined	undetermined	undetermined

2) *The average annual costs of developing TMDLs, primarily by states, over the next 15 years is estimated to be between $63-69 million per year, nation wide.*

– It will cost approximately $1 billion over 10 to 15 years for the 36,000 TMDLs in the over 20,000 water bodies known to be impaired. These costs could be higher or lower by 10%, depending on the pace that states adopt the most efficient approaches to develop TMDLs.

- The average cost of developing the TMDLs for each of the roughly 20,000 impaired water bodies is estimated to be about $52,000, with a typical range of costs between $26,000 and over $500,000.

- EPA expects that states will increase the number of TMDLs developed each year, spending about $30 million in the year 2000, $43-48 million in 2002, and about $68-75 million starting in 2005 and each year thereafter until 2015.

- The cost estimate is based on the unit costs typical for the majority of TMDLs. EPA estimates that only 2-5% of the TMDLs nationally might have costs in excess of the range of costs used in this analysis which, to the extent that these prove to have sufficiently higher costs, might increase the national TMDL development costs by perhaps 10 to 20%.

- The costs of TMDL development cited in the Report are based on compliance with the current regulations including the TMDL regulations published in July 2000. The costs of the additional requirements associated with the July 2000 regulations represent less than 10% of the total development costs estimated in this report. The July 2000 regulations added requirements that increased the costs to develop TMDLs but did not add additional requirements, or therefore costs, to implement TMDLs.

- It is expected that technical assistance that is routinely provided by other governmental agencies, such as the U.S. Department of Agriculture, will experience increased demand as a result of the TMDL program. But EPA has not estimated that cost.

3) *The cost of water quality monitoring to support the development of TMDLs is expected to be approximately $17 million per year.*

- EPA made a preliminary estimate of additional monitoring needed for TMDL development from a limited survey of state experiences to date. This estimate needs to be revised as states gain more experience with TMDL development.

4) *Clustering TMDLs through a watershed approach to development of TMDLs can significantly reduce the costs of developing TMDLs and implementing the resulting pollution control measures.*

- EPA evaluated the extent to which impaired waters listed by states fall into logical geographic clusters for the purpose of developing TMDLs and concluded that as many as 80% of the water bodies nationally could realize cost-efficiencies from developing TMDLs jointly. The cost analysis assumes that states will increasingly be able to realize these efficiencies over a 5-10 year transition period, resulting in a

national average of 60-70% of the waterbodies achieving cost efficiencies from clustering. The analysis estimates that the 36,000 TMDLs will be developed in about 6,000 to 8,000 submissions averaging 5-6 TMDLs per submission. These may consist of as few as one TMDL per submission to more than 30 TMDLs in each but averaging 5-6 TMDLs per submission.

- The development of more cost-effective TMDLs on a watershed basis creates opportunities to shift pollution control responsibilities from high cost controls over point source discharges to comparatively low cost controls over nonpoint sources. Savings attributable to this efficient allocation of pollution control responsibilities are estimated to be between $140 - $235 million per year.

- Increased costs to nonpoint sources that may occur when the more cost effective solutions are implemented are more than offset by savings to point sources.

5) *EPA provides substantial funding to the states for management of the full range of Clean Water Act programs.*

- Using the high end of the range of costs for core TMDL development, and TMDL related monitoring, and assuming a further 10-20% cost increase to account for particularly high cost TMDLs, total TMDL development costs are expected to be as much as $65-74 million in 2002, rising to about $92-107 million annually in 2005 through 2015.

- In FY 2001, the resources available to states to develop TMDLs include:

  - Funding Under Section 106 Water Program Grants – Funding for implementation grants under this core water program increased from $115 million in FY 2000 to $170 million in FY 2001, with an indication from the Congress that the $55 million increase was associated with the TMDL program costs.

  - Funding Under Section 319 Nonpoint Pollution Control Grants – Funding for implementation of state nonpoint pollution control programs increased from $200 million in FY 2000 to $237 million in FY 2001. EPA has provided that states may use up to 20% of this funding (i.e. about $47 million) to develop TMDLs.

  - Planning Funds from State Revolving Loan Funds Grants -- Under section 604(b)(3) of the Clean Water Act, states may use up to one percent of grant funds (or $100,000, whichever is greater) for planning and related purposes, including development of TMDLs. In FY 2001, the total funding available under this authority was $14 million.

- In FY 2001, EPA expects to invest about $21.7 million in management of the current TMDL program. About $10 million of this funding is available to EPA Regions as contract funds to support development of TMDLs at the request of a state or where a state does not develop a TMDL called for in a consent decree.

- EPA expects these funding levels to be maintained, or to increase slightly increase in FY 2002.

I. Introduction

The 1972 Clean Water Act established a blueprint for a sustained effort by government at all levels and the private sector to protect and restore the quality of the Nation's waters. Implementation of the range of programs authorized in the Act over the past 30 years has resulted in dramatic improvements to the quality of rivers, lakes, wetlands, and coastal waters across the country. Today, a significant portion of the Nation's waters meet the "swimmable, fishable" goals set out in the Clean Water Act.

The success of water pollution control programs is causing a gradual change in the approach to water pollution control. In the past, water pollution problems were common and easily identified. Broad, national programs were well suited to remedying problems and preventing further decline in water quality. Today, many of the most obvious problems have been solved. Despite this progress, serious water pollution problems remain. These problems promise to be more difficult to solve because they are driven by specific local conditions and are caused by a wider array of sources. To meet the water pollution challenges of today, government, the private sector, and citizens are increasingly asking two key questions –

- how do we best maintain past progress and protect the majority of waters with good water quality? and,

- how do we best identify each of the remaining water bodies that do not meet clean water goals (i.e. waters that do not attain state water quality standards) and implement cost-effective remedies for them?

This report addresses the question of how to begin to correct the remaining water pollution problems throughout the country in the most cost-effective manner. It is in direct response to a request contained in the Conference Report #106-988 describing the VA/HUD and Independent Agencies Appropriations Act for FY 2001. That Conference Report called on EPA to provide a "comprehensive assessment" of both development and implementation costs of the "Total Maximum Daily Load" (TMDL) program. Although some aspects of these issues were addressed in the economic analysis prepared for the July 2000 TMDL regulations, many individuals and organizations are interested in a more comprehensive review of costs and related considerations than that required for the development of the July 2000 regulations.

The costs of developing and implementing TMDLs should appropriately be considered within the context of the overall effort to protect and restore water quality under the Clean Water Act. The TMDL program is not an end in itself -- it is a tool to help organize information and make decisions regarding how best to respond to impaired waters to begin to take the necessary steps that will eventually lead to attaining the water quality standards adopted by the states or revising those standards to more accurately reflect local conditions. TMDLs fit within the continuum envisioned by the Clean Water Act of designating uses for the various waters in a state, assigning water quality criteria for these uses, monitoring to determine whether water quality standards are met, and if they are not, taking the proper additional actions called for by the specific conditions in that watershed.

After describing the overall context of clean water programs, this report estimates the costs to develop TMDLs, including the costs of monitoring related to TMDL development. This report compares these results to actual experiences of states and EPA to date. The report also estimates the implementation costs under various TMDL program scenarios for pollution sources to achieve reduced discharges consistent with TMDLs. In addition, as required by Conference Report #106-988, economic analysis issues raised by the Comptroller General are addressed (see Appendix A).

In December of 2000, EPA published a notice in the Federal Register asking for information on TMDL program costs. EPA received approximately 90 comments. Twelve state agencies in charge of the TMDL program provided information on their costs, mostly to develop TMDLs, and 7 state agencies involved in implementation provided some information on their costs. Most comments submitted by point and nonpoint pollution sources provided one or two examples of costly TMDLs. One commenter presented comprehensive implementation costs for NPDES dischargers. These comments, as well as experienced experts engaged in development and implementation of TMDLs were considered in the development of this report.

II. Background – Impaired Waters Under the Clean Water Act

A brief review of the statutory basis for the TMDL program and the history of efforts to review and revise the program over the past several years provides useful background for understanding what developing and implementing TMDLs entails. The background information provided below addresses several topics:

- the statutory basis in the Clean Water Act for responding to impaired waters and the role that the TMDL program, as described in §303(d), plays in this effort;
- the TMDL program regulations established in 1985 and amended in 1992 which are currently in effect;
- the litigation challenging state and EPA implementation of the regulations and the Act;
- the Federal Advisory Committee that considered the TMDL program during 1996 and 1997 and made recommendations for further actions;
- the amendments to the TMDL regulations proposed in August of 1999 and published in July 2000 but not effective until October 30, 2001, at the earliest.

The Clean Water Act

The Clean Water Act includes a number of programs aimed at improving, maintaining, and restoring water quality, ranging from effluent limits and permits for point source discharges and funding for sewage treatment facilities, to state grants to reduce nonpoint sources of pollution. As discussed below, these programs are designed to provide general protection for all waters, to define environmental goals for the nation's waters, and to offer a process for assuring that waters failing to meet these goals will be restored.

An early goal for the Nation's clean water program was the implementation of nationally consistent pollution controls for discharges from sewage treatment plants and industrial facilities. These controls were determined based on assessment of the best treatment technology available and affordable. Installation of pollution controls that would meet these national performance standards was assured through the National Pollutant Discharge Elimination System (NPDES) permit program under §402 of the Act. Most sewage treatment plants and industrial facilities have permits requiring basic treatment of discharges consistent with these national requirements.

While much of the early focus of the clean water program was on development of discharge permits, the Act also called for efforts to implement basic controls of runoff or pollution from "nonpoint" sources. Under §208 of the Act, federal, state and local governments worked together to develop area-wide plans that would reduce point and nonpoint source pollution. The effort to reduce nonpoint source pollution was expanded by the creation of §319 in the 1987 amendments to the Act. The 1987 amendments also provided for expanded efforts to control

dischargers of storm water by bringing the most significant dischargers within the scope of the NPDES permit program.

The Clean Water Act includes a second tier of protection for the Nation's waters. Under §303 of the Act, states adopt water quality standards for their waters and EPA must approve those standards. States further review their standards at least every three years and modify them, as appropriate. These water quality standards describe the "designated use" of the water and include both general, narrative criteria and numerical, pollutant specific criteria that need to be attained to protect the designated use. Where the basic pollution controls applied to point and nonpoint sources of water pollution do not result in the attainment of the water quality standards, the water body is considered impaired.

Congress provided specific mechanisms for attaining the standards called for in §303. In the case of a water body found to be impaired by a particular pollutant, the first, most direct recourse is to identify the permits that allow the discharge of that pollutant. Most specifically, §301(b)(1)(C) of the Act requires that each discharge permit include effluent limitations as necessary to assure that the water quality standards for the water body are met. Many of the permits originally issued to dischargers focused on nationally applicable requirements but did not include limits needed to assure that the site-specific water quality standards would be attained. In recent years, EPA and states that have been authorized to issue Clean Water Act permits, have increasingly issued permits that include these "water quality-based" limitations, and these permits have helped reduce degradation of water quality and violation of water quality standards.

The Clean Water Act permit issuing authority (i.e. the EPA or a state authorized to issue Clean Water Act permits) can revise the permits to include water quality-based limits resulting in additional pollution controls pursuant to §301(b)(1)(C) of the Act. For example, a portion of a river is found to have chromium in excess of the water quality criteria for chromium. The state identifies chromium in the discharge from a tannery. The tannery is in compliance with the basic treatment requirement, but the permit is revised to include water quality-based limits requiring further reductions in the discharge of chromium needed to attain the water quality standard. In many cases, use of these "Water Quality-Based Effluent Limits" (WQBELs) have enabled attainment of water quality standards.

Unfortunately, many of the water pollution problems around the country are the result of multiple pollutants coming to a water body from a range of point and nonpoint sources. In these cases, the basic requirement that a NPDES discharge permit not result in violation of a water quality standard (i.e., §301(b)(1)(C)) still applies. The simple application of this requirement, however, could result in imposing significant pollution control burdens on a single discharger when a group of dischargers is causing the problem. It could also result in imposing significant pollution control burdens on a group of point source dischargers when both NPDES discharges and nonpoint sources contribute to a problem, even if measures to reduce nonpoint pollution could be significantly cheaper than point source controls. In addition, if nonpoint sources, in the aggregate, are the major sources of the pollutants, point source controls alone may be inadequate to attain standards.

Congress recognized that assuring the attainment of water quality standards, especially in the case of impaired waters, can involve multiple pollutants, multiple sources, and multiple segments of a water body. Although Congress never waived the requirement that permits result in attainment of water quality standards (as mentioned above regarding §301(b)(1(C)), it created the TMDL program in §303(d) of the Act. Section 303(d) calls for states to identify impaired waters and, more importantly, offers an approach to attaining standards in a water body other than the simple tightening of individual discharge permit limits. In effect, it allows for an assessment of pollution problems on a larger geographic scale and the development of a plan for restoring the health of the water body that includes allocation of pollution control responsibilities to a range of point and nonpoint sources in the manner deemed most appropriate in the specific circumstance. States and interested stakeholders are able to consider factors such as relative cost-effectiveness of pollution control measures, reliability of measures, and equity in devising these plans. The TMDL program offers significant flexibility in devising remedies for impaired water bodies, but it retains the bottom line requirement that the TMDL must be set at a level that will result in attainment of the water quality standard adopted by the state.

The Clean Water Act gives states the lead responsibility for developing lists of impaired waters and developing TMDLs. EPA's role in the process is to support states and to review and approve the lists and the TMDLs. EPA is also to establish a list or a TMDL in certain cases, for example when it disapproves one or the other submitted by a state.

Finally, although state adopted water quality standards express society's goal for the health of a water body, the standards are not irrevocable. States may revise water quality standards to make them more or less protective of aquatic systems, subject to Clean Water Act program regulations and EPA approval. For example, a state may relax a water quality standard when designated uses cannot be attained or the costs of attaining them would cause widespread social and economic disruption. This specific provision may include completing a use attainability analysis of the impaired water and its designated standard or implementing a site-specific or source-specific variance in order to avoid significant harm. Therefore, the CWA includes a safety valve to reassess the goals for an individual water body when attaining those goals would only come at an unacceptable cost. This caps the costs and other social or economic impact that might be incurred either under a WQBEL or a TMDL for pollutant sources affecting an impaired water body.

Current TMDL Program Regulations

EPA issued regulations governing identification of impaired water bodies and establishment of TMDLs, at 40 CFR §130.7, in 1985 and revised them in 1992. These regulations, which are currently in effect, provide that:

- Pursuant to §303(d), States must periodically list those waters where existing pollution controls are not stringent enough to attain and maintain applicable water quality standards;

- §303(d) lists must be submitted to EPA every two years, beginning in 1992, on April 1 of every even-numbered year;

- A priority ranking for listed waters must include an identification of the pollutant or pollutants causing or expected to cause the impairment and an identification of the water bodies targeted for TMDL development in the next two years;

- States, in developing lists, must assemble and evaluate all existing and readily available water quality-related data and information;

- States must submit, with each list, the methodology used to develop the list and provide EPA with a rationale for any decision not to use any existing and readily available water quality-related data and information; and

- TMDLs must be established at levels necessary to implement applicable water quality standards with seasonal variations and a margin of safety that takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality.

A TMDL specifies the amount of a particular pollutant that may be introduced into a water body and allocates the total allowable pollutant loads among sources, thereby providing a road map for efforts to attain and maintain state water quality standards. TMDLs are established for water body and pollutant combinations for water bodies impaired by point sources, nonpoint sources, or a combination of both point and nonpoint sources.

Citizen Suits for TMDL Implementation

While the TMDL provisions have been in §303(d) of the Clean Water Act since 1972, states and EPA did not emphasize implementation of §303(d) until relatively recently. As noted above, during the 1970s and 1980s, the focus of state and EPA efforts was to establish performance standards for industrial dischargers and sewage treatment facilities. As a result, many state lists of waters needing a TMDL were limited to a few waters and relatively few TMDLs were developed.

The Clean Water Act specifically provides that EPA has a duty to review and approve the list of impaired waters and TMDLs submitted by a state and to develop a list and/or TMDL where a state submission was disapproved. Some states did not develop lists or TMDLs, yet EPA did not take a disapproval action nor develop lists or TMDLs for those states.

In the early 1990's, citizen organizations began bringing legal actions against EPA seeking the listing of waters and establishment of TMDLs. One argument made by many of the organizations bringing these lawsuits was that, under §303(d), the failure to submit any list or any TMDL constituted a "constructive submission" of no list or TMDL. The failure to act was, at least in effect, an action that required an EPA response. They argued that EPA has a mandatory

duty under the Clean Water Act to act for a state that does not implement §303(d). Although EPA opposed this argument in a number of the early TMDL lawsuits, several courts accepted it in various forms and ruled that EPA had a duty under the Clean Water Act to establish TMDLs in the face of state inaction.

To date, environmental groups have filed about 40 legal actions in 38 states. Most of the lawsuits have been filed since the mid-1990s. They generally argue that EPA must establish TMDLs where a State fails to do so. Over 20 of these lawsuits have resulted in court orders or consent decrees under which EPA is required to establish TMDLs if the State fails to do so in a timely manner.

By the mid-1990's, the Agency initiated a new effort with states and other stakeholders to put the program on a sounder footing so that courts would be less inclined to direct EPA to establish lists of impaired waters or TMDLs where states had not done so (see discussion of TMDL Federal Advisory Committee below). At the same time, EPA developed a clearer standard for determining the sufficiency of state implementation of a TMDL program involving a three part test where: 1) the state has established TMDLs; 2) the state has a plan for implementing TMDLs in the future; and 3) the state is engaged in and supporting the plan.

The TMDL Federal Advisory Committee

In 1996, EPA determined that there was a need for a comprehensive evaluation of EPA's and the states' implementation of their §303(d) responsibilities. EPA convened a committee under the Federal Advisory Committee Act (TMDL FACA Committee) to undertake such an evaluation and make recommendations for improving implementation of the program, including recommended changes to the TMDL regulations and guidance.

The TMDL FACA committee was comprised of 20 individuals with diverse backgrounds, including agriculture, forestry, environmental advocacy, industry, and state, local, and tribal governments.

On July 28, 1998, the committee submitted its final report to EPA containing more than 100 consensus recommendations, a subset of which would require regulatory changes. Key recommendations of the FACA included:

- restoring impaired water should be a high priority for all agencies and sources;
- all TMDLs should be completed expeditiously but no later than 8-15 years after listing according to a schedule developed by the state;
- the TMDL process should include key steps such as target identification, allocation of pollution loads, an implementation plan, and evaluation procedures;

- states should have discretion in making allocations among sources as long as the allocation will result in the attainment of water quality standards; and

- stakeholders should play an active role in the TMDL process.

The committee was unable to reach consensus on several key issues, including:

- whether implementation plans should be required as part of the TMDL under §303(d) of the CWA or required as part of the state Continuing Planning Process under §303(e); and,

- whether TMDLs should be required for waters impaired by atmospheric deposition.

July 2000 TMDL Program Regulation Revisions

Building on the recommendations of the TMDL Federal Advisory Committee, EPA drafted revisions to the existing TMDL regulations and published proposed TMDL program changes on August 23, 1999. EPA engaged in an extensive outreach and information-sharing effort following the publication of the proposed rule. The Agency sponsored and participated in six public meetings nationwide, to better inform the public on the contents of the proposed rules, and to get informal feedback from the public. These meetings took place in Denver, Los Angeles, Atlanta, Kansas City, Seattle, and Manchester, New Hampshire. EPA received about 34,000 comments on the proposal.

The Agency also consulted with state and local officials and their national/regional organizations throughout the development of this rule. For example, EPA met with organizations representing state and local elected officials including: the National Governors' Association, the Western Governors' Association, the National Conference of State Legislatures, the National Association of Counties, the National League of Cities and EPA's State and Local Advisory Group.

On July 13, 2000, EPA published final revisions to the TMDL regulations. Key elements of those regulations include:

- more comprehensive lists of all water bodies that do not attain and maintain state water quality standards with revision of the lists every 4 years rather than every 2 years;

- a schedule, based on priority factors, for establishing all needed TMDLs over 10 years, with an allowance for another five years where necessary;

- an enumeration of 11 specific elements of a TMDL, including implementation plans that identify lists of actions and expeditious schedules to reduce pollutant loadings and attain water quality standards;

- requirements for documentation of "reasonable assurance" that reliable nonpoint source controls would be implemented;

- prompt action to implement needed pollution controls and a goal of meeting water quality standards within 10 years;

- expanded opportunities for public comment on listing methodologies, lists, prioritized schedules and TMDLs prior to submission to EPA;

- specific time frames under which EPA will assure that list of impaired waters and TMDLs are completed as scheduled.; and

- new authority for EPA to object to and if necessary, reissue expired and administratively-continued NPDES permits issued by states.

As the Agency was finalizing these rules, Congress enacted an amendment to the Military Construction Appropriations Act: Supplemental Appropriations (PL 106-426). This provision prohibited EPA from using FY 2000 or 2001 funds to "make a final determination on or implement" the July 2000 regulations. EPA published the final rule before the legislation was signed into law and established the effective date of the new TMDL regulations as 30 days after the expiration of this prohibition, or at the earliest, October 30, 2001.

III. Current Efforts to Protect and Restore the Nation's Waters

Progress in improving water quality over the past several decades has involved substantial expenditures by government at all levels and by the private sector. Understanding the scale of these efforts provides a useful perspective on the costs of the TMDL program that are presented in Section V of this Report.

In the most general terms, expenditures for water quality can be thought of as the total of:

- Governmental spending to administer clean water programs;

- Public and private capital investments to prevent the generation of pollution and to collect and treat wastewater to remove the pollutants. Such capital investments range from sewer systems to treatment plants to constructed measures to reduce runoff from agricultural fields and other land. Investments are occurring to improve the collection and treatment of wastewater from existing sources, to replace existing wastewater treatment facilities as they near the end of their useful life, and to address the potential for new pollution from a growing population and industrial base; and,

- Municipalities and industry incur substantial operating and maintenance expenses to minimize discharge from potential polluting activities and to keep the clean water capital equipment in good working order. Research and development also represents another important cost.

A substantial majority of current spending is to comply with the provisions of the Act requiring implementation of performance-based water pollution controls. While many NPDES dischargers do have Water Quality Based Effluent Limits (WQBELs) in their permits to comply with the health/environmental goals for the Act, including state water quality standards, this is a comparatively small investment compared to the overall investments by dischargers as a result of the national system of performance-based water pollution controls. Federal and state program administration costs are the smallest part of this spending.

The performance-based requirements of the Clean Water Act and related statutes include:

- Effluent guidelines requiring direct industrial dischargers to meet effluent limits based on the best conventional pollution control technologies (for conventional pollutants discharged by existing sources) and the best available treatment technologies that are economically achievable (for toxic and nonconventional pollutants discharged by existing sources) or new sources performance standards (for new sources). Effluent guidelines have been established for more than 50 major categories of industrial dischargers (both existing and new sources) under Sections 301 and 304 of the Act;

- Categorical pretreatment standards controlling discharges by industries to publicly owned sewage treatment plants under §307 of the Act. These standards are also included in the effluent guidelines;

- Standards requiring all sewage treatment plans to treat their effluent to meet secondary treatment performance standards under §304 of the Act;

- Storm water management requirements for municipalities, industry and construction sites;

- Voluntary reduction of polluted runoff from major categories of nonpoint sources largely supported by grants and state matches under §319 of the Act; and,

- Implementation of management measure to reduce nonpoint pollution in coastal waters under §6217 of CZARA.

As noted above, in very general terms, a substantial majority of the on-going spending is to comply with the provisions of the Act requiring implementation of performance-based water pollution controls, with the biggest share contributed by public entities for sewage collection and treatment.

IV. Defining Today's Water Pollution Problems -- The 1998 §303(d) Lists

Section 303(d) of the Clean Water Act requires states periodically to develop a list of their impaired water bodies (i.e. water bodies that do not meet water quality standards) and requires that EPA review and approve those lists. The most recently required submission of lists was in April, 1998. EPA waived the requirement for a 2000 list because it was in the process of revising the program regulations. The 1998 §303(d) lists thus provide the most recent comprehensive picture of the states' understanding of impaired waters in the United States.

The states and territories identified nearly 22,000 individual water bodies, including river and stream segments, lakes, and estuaries, that do not attain state water quality standards despite 28 years of pollution control efforts under the Clean Water Act. Table IV-1 includes important information concerning the section 303(d) lists of impaired waters.

These impaired water bodies include approximately 300,000 miles of rivers and coastal shoreline and approximately 5 million acres of lakes. This quantity of impaired waters represents about 1/3 of the length/acreage of all waters in the U.S. whose quality has been assessed, or about 10 % of all the waters nationwide. Approximately 210 million people live within 10 miles of one or more of the impaired water bodies currently listed under §303(d).

The list of impaired water bodies may grow in the future as more waters are assessed. However, the one-third fraction of assessed waters that we are currently finding to be impaired is much greater than the fraction of the currently unassessed waters that will ultimately be found to be impaired. The quality of the waters that are assessed now, equal to approximately one-third of all the waters, is likely generally worse than the quality of the waters that have not yet been assessed. This is because assessment efforts to date have tended to focus on: 1) waters that are important and heavily used (i.e., near urban areas and thus more likely to be degraded); and 2) waters that are likely to be impaired (i.e., monitoring is often employed to determine whether waters suspected of being impaired are so; while it is rarely used to confirm that waters that are expected to be pristine really are so).

If these §303(d)-listed waters are to meet state water quality standards and the goals of the Clean Water Act are to be achieved, pollutant sources affecting these waters must implement additional controls beyond applicable performance-based requirements for point sources and existing management practices for nonpoint sources. Through interpretation of the information from states, we estimate that less that 5 % of these waters are impaired by point sources only and a further 25% are impaired by a combination of sources that includes point sources. About half of the §303(d) waters are impaired by nonpoint sources exclusively, and the remainder are impaired by various combinations of nonpoint, "other", and unknown sources. In addition to the use of individual water quality-based permits for point sources under §301(b)(1)(C) discussed above, the Clean Water Act includes the TMDL process as an additional means of attaining these varied water body-specific standards. For each listed water where the impairment is caused by a specific pollutant, rather than some other environmental cause such as flow or habitat modification, the Act requires that a state establish the total maximum daily load that will provide for attainment of the applicable water quality standards, with seasonal variation and a margin of safety. The Act

does not specify how the TMDL is to be achieved, which sources are to be addressed, or how responsibilities for further controls are to be apportioned among the sources contributing to impairment. EPA's regulations implementing this section of the Act retain this flexibility -- EPA requires only that all sources of the impairing pollutant be considered, and that wasteload allocations be assigned to all relevant point sources and load allocations be assigned to all relevant nonpoint sources.

Table IV-1
Overview of the States' 1998 §303(d) Lists

States and territories listed 21,851 impaired waters. They cite 41,331 causes of impairment for these waters, an average of nearly 2 causes per water. Under the July, 2000 regulation, each cause -- with the exception of those such as habitat alteration or flow alteration that do not involve a pollutant ("impaired by pollution but not a pollutant") -- requires a TMDL. EPA estimates that roughly 37,000 of the causes will require TMDLs. The following information describes these impaired waters.

Leading Causes of Impairment (41,331 cited)

Sediment	14.8%
Pathogens	12.8%
Nutrients	11.5%
Metals	9.6%
Dissolved oxygen	9.6%
Other	5.8%
Habitat alteration	5.1%
Temperature	4.6%
pH	4.4%
Toxic organics	3.7%
Impaired biologic community	3.5%
Flow alteration	2.7%
Mercury	2.6%
Remainder	5.9%

Leading Sources of Impairment (21,700 cited)*

Agriculture	24.6%
Other source	12.8%
Flow or habitat alteration	12.0%
Nonpoint source (not classified)	11.4%
Resource extraction (mining, oil&gas)	9.6%
Municipal point sources	8.5%
Urban runoff/storm sewers	6.8%
Unknown source	4.6%
Atmospheric deposition	2.6%
Construction	2.5%
Silviculture	1.9%
Industrial point sources	1.0%
Remainder	1.6%

*(Source information is reported for only about half of all waters)

Area of Impaired Lakes (2,946 total lakes)

< 10 acres	9.5%
10 - 500 acres	56.6%
> 10,000 acres	3.5%

Length of Impaired River Segments (15,721 total segments)

<1 mile	7.2%
1 - 20 miles	74.4%
20- 100 miles	16.84%
> 100 miles	1.6%

V. Administrative Costs to Develop TMDLs

The TMDL program has two specific administrative activities that states (or EPA, if needed) must perform:

- ***Listing Impaired Water Bodies.*** States must identify their specific impaired water body segments and periodically submit the resulting list, including supporting material, to EPA.

- ***Developing TMDLs.*** For each pollutant cause of impairment for each listed water body, the state must develop a specific plan (a "TMDL") that will achieve the applicable water quality standards. The plan will involve establishing the total maximum daily load the water body can tolerate, identifying the specific sources contributing the impairment pollutant to the water body, and allocating the total allowable load among the contributing sources. Under the July 2000 rule, each TMDL is also to include an implementation plan, specifying the actions to be taken, the timetable, and the responsible parties.

EPA has estimated the costs for the states and EPA to perform these activities, focusing on the waters listed on the1998 §303(d) lists. In addition, this section identifies costs to states of monitoring specifically associated with development of TMDLs.

- ***Implementing the TMDLs.*** For this report, we were not able to estimate separately the potential increased administrative costs to the states and EPA that might be associated with implementing TMDLs. To implement a TMDL, the state will need to revise NPDES permits to require the wasteload reductions desired from point sources, and to implement an appropriate range of programs (voluntary, incentive-based, and/or regulatory) for targeted nonpoint sources. To a large extent these activities, such as revising NPDES permits and working with nonpoint sources, are already part of the states' water program efforts. The extent to which implementing TMDLs will result in the need to increase these efforts is unclear. To a large extent, the need to implement TMDLs may only change the timing or the focus of current efforts rather than increase their cost. For point sources, states renew permits every five years, so timing and costs are unlikely to be affected. On the other hand, in some states, especially for efforts related to nonpoint sources, expansion of current programs may be needed.

A) The Cost of Listing Impaired Waters

EPA estimated the cost of meeting the listing requirements of §303(d) prior to the July 2000 rule in its periodic Information Collection Request (ICR). Subsequent to public comment on the draft ICR, OMB approved the ICR (#1560.05) for the period covering March 2000

through April 2003. The national burden to states for each listing, prior the July 2000 rule, was estimated to be about $1 million and listings were required every 2 years.

The July 2000 TMDL rule requires states to improve their methodologies for setting priorities, establish schedules for developing TMDLs, increase public participation, provide their lists in a consistent format, and convey the essential information supporting the listing. As described in the supporting Economic Analysis,[1] the bulk of the cost associated with these requirements would be a one-time transition cost that would be incurred for the first listing under the rule, and there would be smaller on-going costs for future listings. The one-time cost for the transitional first listing was estimated at about $1.3 million, and the additional cost for subsequent listings was estimated to be about $0.2 million.

However, the July 2000 rule also eliminated half of the future listings by changing the listing cycle from 2 years to 4 years, thereby saving about $0.8 million every four years.[2] By 2011, on an undiscounted basis, the savings associated with the 4 year cycle will exceed the additional cost of the new listing-related requirements of the July 2000 rule. By 2015, the total undiscounted cost of listing under the current program will be $6.9 million in comparison with the July 2000 rule's cost of $6.5 million. On a discounted cost basis, using a 7% discount rate, the revised rule begins to save money after the 2014 listing. Thus, the 15 year discounted costs of listing under the current rule and the July 2000 rule are approximately the same at $4.5 million.

B) The Cost of Developing TMDLs

In estimating the national cost of developing TMDLs, EPA combined information on the number of TMDLs that will need to be developed with information on the unit costs of developing TMDLs of various types. The analysis also considered varying unit costs as a function of the complexity of different TMDLs, and the potential efficiencies that can be obtained by coordinating the development of TMDLs within watersheds.

The Number of TMDLs Needed

For the purpose of this analysis, EPA assumed that states will develop TMDLs for all water bodies on the section 303(d) lists that are impaired by one or more pollutant.

In the 1998 §303(d) lists, states identified nearly 22,000 water bodies impaired by more than 41,000 causes of various types. Roughly 37,000 of these causes of impairment on 20,000 water bodies involve pollutants, and thus must be addressed by TMDLs. EPA's most recent

---

[1]Environomics and Tetra Tech, Inc. *Analysis of the Incremental Cost of Final Revisions to the Water Quality Planning and Management Regulation and the National Pollution Discharge Elimination System Program*, prepared for the U.S. EPA, Office of Wetlands, Oceans and Watersheds. July 7, 2000.

[2]Even though an entire listing would be avoided every 4 years, the Economic Analysis assumed that only 80% of the cost of a listing would be saved since some of the activities associated with listing would likely continue to occur anyway on an annual basis.

estimates indicate that about 1,000 of these TMDLs were developed prior to 2000. Therefore, as of the beginning of 2000, there were approximately 36,000 more TMDLs that will need to be developed to address the causes of impairment identified in the 1998 §303(d) lists.

Although EPA has developed cost estimates based on the assumption that about 36,000 TMDLs need to be developed, this estimate may understate or overstate the actual costs to be incurred because some water bodies will be addressed through means other than the development of a TMDL. For example, a state may issue a revised NPDES permit with more stringent permit limits for a single discharger to an impaired water body, and this may result in achieving water quality standards before a TMDL is initiated. Similarly, implementation of other pollution controls, such as new storm water discharge permits or controls over combined sewer overflows, may result in attainment of standards prior to development of a TMDL. In addition, some states have indicated that the 1998 lists include waters for which there is insufficient data to establish impairment and these waters may be removed from the lists in the next listing cycle.

At the same time, it is important to remember that some waters that are now impaired, or that will become impaired in the future, are not included on the 1998 lists of impaired waters. EPA estimates that about 1,000 new waters will be added to 303(d) lists per four year listing cycle starting with the 2006 listing cycle to a total of 9,000 new listings by 2038. Each such addition of 1,000 waters will result in an additional workload of about 100 TMDLs per year (i.e., the 1,000 TMDLs will be developed at an even pace over the 10 years subsequent to the date of listing).

The Unit Cost of Developing TMDLs

In estimating the cost of developing TMDLs consistent with the July 2000 regulations, EPA includes costs for performing eight basic steps:

1. characterizing the watershed,

2. modeling and analyzing the water body and its pollutants to determine the reduction in the pollutant load that would eliminate the impairment,

3. allocating load reductions to the appropriate sources,

4. preparing an implementation plan,[3]

5. developing a TMDL support document for public review,

6. performing public outreach,

[3]This step is not a required element of the TMDL under the 1992 rules, but EPA encouraged such action in an August, 1997 memorandum from the Assistand Administrator for Water and many states are preparing such plans. The July 2000 regulations explicitly require that a TMDL include an implementation plan.

7. conducting formal public participation and responding to it, and

8. management (including tracking, planning, legal support, etc.).

When developing TMDLs, states can obtain substantial cost savings by working on a watershed basis. By coordinating the development of multiple TMDLs within a watershed, efficiencies can typically be realized for every step of the TMDL development processes. For this reason, the July 2000 regulation encouraged states to incorporate this important consideration when setting priorities and planning for developing TMDLs. Grouping TMDLs for coordinated development is consistent with current trends in internal state management of water programs, with half of the states already using a basin management approach to address monitoring, evaluation, public meetings and permitting efforts. In addition:

- A large sample of 1,096 TMDLs for 668 water bodies recently submitted to EPA[4] indicates the extent to which states are already beginning to adopt approaches for efficiently developing TMDLs. These 1,096 TMDLs were grouped together by the states into 496 submissions. About half of the submissions, representing only about 25% of the TMDLs, were for a single TMDL for a single water body. The remaining submissions either grouped all of the TMDLs for a single water body together or grouped all of the TMDLs for several water bodies together. Overall, more than half of the TMDLs benefitted from the cost efficiencies that can be realized by coordinating the development of TMDLs for water bodies requiring multiple TMDLs and by coordinating the development of TMDLs for multiple water bodies within watersheds.

- To assess the potential for realizing such efficiencies in the future, EPA analyzed nearly all of the water bodies on the 1998 §303(d) lists – the analysis was done for all of the water bodies on the 1998 §303(d) lists for which adequate data were available, representing 77% of the water bodies and 70% of the causes nationally. For these water bodies, we were able to identify the groups of water bodies that were interconnected (i.e., flowed into one another) within watersheds. Based on this analysis, over 85% of the TMDLs could potentially realize varying degrees of cost efficiencies. Based on this detailed analysis it is clear that the potential for coordinating the development of TMDLs to achieve cost savings is substantially greater than reflected in the recent sample of 1,096 TMDLs submissions.

Thus, EPA anticipates that in the future states will increasingly be able to adopt efficient practices when developing TMDLs.

The cost of developing TMDLs can be viewed at different levels of aggregation in addition to the national total. Accordingly, Table V-1 provides the national average cost and the

[4]The TMDLs were prepared by 35 states in 9 EPA Regions for over 60 different types of causes, and were submitted over the period April 1998 through September 2000.

associated typical range of costs in developing TMDLs for: 1) a single cause of impairment; 2) a water body that requires multiple TMDLs; and 3) a submission that may range from a single TMDL for a single water body to many TMDLs for all the water bodies in a watershed.

As summarized in Table V-1, the cost per cause is estimated to be about $28,000 on average nationally, but can typically range from about $6,000 to $154,000. The lower end of the range reflects the typical cost associated with TMDLs that are the easiest to develop and also have the benefit of maximum efficiencies (for example, the TMDL for the second nutrient pollutant for a water body). The higher end of the range represents the typical cost associated with TMDLs that are most difficult to develop, and for which there isn't the benefit of related work done on other TMDLs for the water body or the watershed. Note that the range of $6,000 to $154,000 per TMDL broadly represents the typical cost of developing TMDLs, with perhaps only 2-5% of the TMDLs nationally costing more than this range.

Table V-1
National Average & Typical Range for the Unit Cost of Developing TMDLs

Level of Aggregation	National Average Cost* (thousands 2000 $)	Typical Range for Cost (thousands 2000 $)
Cost per single cause of impairment (for single TMDL)	$27 - $29	$6 - $154
Cost per single water body (for single TMDLs to multiple TMDLs)	$49 - $54	$26 - over $500
Cost per submission (for single water bodies to multiple water bodies)	$136 - $165	$26 - over $1,000

**Ranges reflect a 5-10 year transition period over which states are assumed to fully achieve the cost efficiencies that can be realized by clustering water bodies and causes when developing TMDLs.*

The cost per water body can vary widely. Although most water bodies have only one cause of impairment requiring a TMDL, nearly 40% of the water bodies on the 1998 §303(d) lists have two or more causes. The number of causes ranges to more than thirty for a single water body. The national average cost of developing TMDLs per water body is estimated to be about $52,000, but can typically range from under $26,000 to over $500,000 depending on the number of TMDLs, their level of difficulty and the extent to which impaired waters are clustered together for TMDL development.

States will usually combine the development of TMDLs into logical, efficient groups and submit them together in a single submission. Submissions may range from a single TMDL for a water body to many TMDLs for all of the water bodies in a watershed. The cost of a submission (which typically may cover 5-6 TMDLs but could have fewer or far more TMDLs) is estimated to be about $150,000 on average nationally, but may typically range from including a single TMDL

for a cost of $26,000 per submission to cases that include a cluster of many water bodies and/or TMDLs at higher levels of difficulty that exceed $1,000,000 per submission.[5]

The National Cost of Developing TMDLs (excluding monitoring)

As of the beginning of 2000, the total undiscounted cost of developing the remaining 36,225 TMDLs for the 1998 §303(d) lists is estimated to be about $1 billion (in 2000 dollars). This cost would be spread over the next ten to fifteen years. This total covers all of the tasks associated with developing TMDLs (except for additional monitoring required to develop the TMDL), including the additional requirements mandated by the July 2000 regulation, even though these rules are not yet effective.

As described in detail in the supporting report, *The National Costs to Develop TMDLs*, this estimate is based on: the number of TMDLs to be developed, the national distribution of the complexity of the TMDLs to be developed, the unit costs for each of the tasks needed to develop TMDLs for each of three levels of complexity, and the potential efficiencies that can be obtained by coordinating the development of TMDLs within watersheds.

In addition, this estimate is based on the assumption that over a 5-10 year transition period, the states would fully achieve the cost savings that can be realized by coordinating the development of TMDLs within watersheds. The total cost of $1 billion could be lower or higher by about 15%, depending on the time needed for states to adopt the most efficient methods for developing TMDLs. Nearly all of the total cost of $1 billion is associated with the requirements of the existing program, with the additional requirements of the July 2000 regulations that affect TMDL development accounting for less than 10% of the total cost.[6]

In this analysis, EPA focused on the national average cost for "typical" TMDLs (as reflected in Table V-1) in order to develop an accurate estimate of the total national cost. EPA did not consider the most inexpensive TMDLs or the most expensive TMDLs because these "outliers" are not representative of the bulk of the national TMDL development workload. We believe that the range of costs used in this report is appropriate for developing an estimate for total national costs. However, to the extent that there is a significant number of outliers with

---

[5]Note that it is not necessary that there to be a single submission in order for the individual TMDLs to benefit from the efficiencies that can be gained from coordinated development. TMDLs can be developed simultaneously, but submitted separately. In addition, the TMDLs do not even need to be developed contemporaneously in order still to benefit from efficiencies, although the resulting efficiencies may be less (for example, much of the watershed characterization and TMDL document could be reused, but the efficiency of holding a joint public hearing would be lost).

[6] The July 2000 rule added one of the eight TMDL development tasks (albeit an important task, preparing an implementation plan) and increased the effort required for another task (public participation). However, it should be noted that even before the July 2000 revision, some states were already performing the additional public participation and were preparing implementation plans. Since August, 1997, in a memorandum from the Assistant Administrator for Water, EPA has been encouraging states to include implementation plans in TMDLs. The remaining tasks were not changed by the July 2000 rule.

sufficiently higher costs, total national costs may ultimately exceed what we estimate in this report. For perspective, if the potential outliers exceed the maximum cost of $154,000 per TMDL by an average of $100,000 per outlier TMDL, then the national total cost estimated in this report would be understated by perhaps10-20%.[7]

A state that wishes to apply the national average estimates and methodology to estimate the cost of developing TMDLs for itself should make the appropriate state-specific adjustments as detailed in the supporting cost analysis to this Report, *The National Costs to Develop TMDLs*. For example, for some states it may be important to explicitly consider outliers.

Annualized Costs of Developing TMDLs

EPA estimates that the average annual national cost for developing TMDLs will be about $63-$69 million. While the July 2000 rule sets a 10 year schedule for developing TMDLs, the rule includes a provision for extending that an additional 5 years when requested by states. The 15 year schedule was used in this analysis. The rate of TMDL development is gradually increasing. About 1,000 TMDLs were developed prior to 2000 and another 1,400 TMDLs were developed in 2000. Therefore, it appears that states are in the process of building up their capacity to develop TMDLs. This estimate of annual costs in based on the assumption that states will develop the needed TMDLs at a roughly uniform pace between 2000 and 2015 or about 2,350 TMDLs per year.

A more likely scenario is a "transition" pace in which TMDL development might steadily increase from 1,000 TMDLs per year in the year 2000 to about 2,550 TMDLs by the year 2005 and remain at that rate through the year 2015. This would result in a yearly cost that would start at about $27-$29 million in the year 2000 and steadily increase to about $68-$75 million in 2005 and remain at that level through 2015.[8]

The Cost of Additional Monitoring Needed to Develop TMDLs

Ideally, the additional cost of monitoring needed to develop TMDLs would have been incorporated in the analysis described above. However, in the time frame for this report, it was not feasible to apply this approach. A general estimate of monitoring costs is provided below.

Federal, state, and local governments, dischargers, citizens groups and others currently perform extensive water quality monitoring for a wide variety of purposes, ranging from basic research to compliance assessment. Some of the major water programs that prompt substantial monitoring efforts include:

---

[7] Note that the average additional cost of $100,000 per outlier represents a range for outliers extending to as much as $1,000,000 per outlier TMDL over and above $154,000. See *The National Costs to Develop TMDLs*, Chapter III. Section B.2.c. for a detailed discussion.

[8]Note that both the uniform rate and the transition rate would be generally consistent with the pace of developing TMDLs needed to comply with the requirements of the consent decrees discussed in Section II.

- Evaluating whether waters support designated uses, as required by §305(b) of the Act;

- Avoiding potentially harmful exposures by those using surface waters (e.g., monitoring of swimming beaches, drinking water intakes, fish and shellfish);

- Evaluating whether NPDES dischargers are in compliance with their permit limits;

- Obtaining data necessary to establish or revise water quality standards; and

- Scientific research (e.g, characterizing pristine waters in order to understand healthy ecosystems, studying the impacts of acid deposition).

Each of these purposes requires differing sorts of monitoring, in terms of scale (national, regional, watershed, stream, site), media (water column, biota, sediments), parameters (flow, temperature, pollutants, biological activities), time frame (continuing, one-time, short term/long term) and other dimensions. In addition, the overall monitoring strategies differ across states.

In some cases, for some water bodies in some states, available monitoring data will be adequate for the development of a TMDL. In other cases, additional monitoring data will be needed. The extent to which existing monitoring will suffice or additional monitoring is needed for any given TMDL will depend on such factors as the nature of the state's monitoring program (e.g., primarily at fixed stations throughout the state, or more in-depth monitoring on a rotating basin basis), the extensiveness of the existing state program, the complexity of the TMDL, particularly the types of sources that need to be addressed, and the availability of monitoring data from other sources, such as data collected by USGS or collected for the drinking water program.

Thus, there is a wide variation across states in the degree to which additional monitoring is likely to be needed in developing any particular TMDL. In addition, monitoring is often done to achieve multiple objectives, and it is not clear how to apportion the costs of these efforts. Therefore, EPA has not attempted to estimate incremental monitoring needs on a per-TMDL basis.

Instead, EPA conducted an informal survey of state monitoring program staff to obtain their judgments on the total monitoring resources needed in their state to support development of all of the state's TMDLs. The Agency surveyed nine diverse states (CO, CT, KS, MD, OH, OK, OR, SC, WV) representing a range of geographic locations, TMDL workloads (a factor of 20 difference between the smallest and the largest), and existing monitoring programs. Each state offered an opinion about the number of monitoring staff that might be required to provide all monitoring information needed for TMDL development in the state. State staff stressed both the unique and judgmental nature of their responses -- the estimates depended on such specific factors as the aggressiveness of the state's TMDL development schedule, whether or not the state has routinely in the past collected stream geometry and flow information, the extent to which the state has received supplemental monitoring assistance from USGS and others, the methods and burden of proof that the state had applied in listing waters, etc.

Each state's monitoring staff were asked specifically to estimate how many full time staff equivalents (FTEs) would be necessary to adequately meet the intensive data needs for TMDL development that are not typically addressed by the state's broader water quality characterization efforts for §303(d) listing, water quality inventories, and other purposes. The responses ranged from 1.5 to 15 FTEs per year per state, with some estimates considering field monitoring staff only and others including support staff as well. While the responses implicitly consider the TMDL development schedules to which states are currently committed, states were quick to point out that these staffing needs would not likely diminish once their 1998 lists were dealt with; the resulting slack would be taken up by follow-up monitoring and efforts associated with future assessments and 303(d) listings.

To begin extrapolating the nine state responses to the remainder of the nation, we related each state's estimate of its TMDL monitoring needs to the miles of pollutant-impaired §303(d)-listed waters in the state. The resulting estimates ranged from one monitoring FTE needed per 2,402 miles of impaired waters to one FTE per 509 miles of impaired waters. The average across the surveyed states was one FTE per 1,168 miles. Dividing the number of pollutant-impaired miles in the nation by 1,168 miles monitored per FTE, we estimate that roughly 247 FTEs are needed nationwide for TMDL-related monitoring.[9]

However, we consider this may be a low estimate, since some states' judgments appeared to include only monitoring field staff, and not the additional planning, laboratory and support services they will need. At $70,000 per FTE (year 2000 dollars),[10] the incremental cost of monitoring for TMDL development is therefore estimated at $17.3 million annually.

C) Federal Share of TMDL Development Costs

We assumed in this analysis that information that is routinely provided by other government agencies, such as the U.S. Department of Agriculture, will continue to be provided, and have not estimated this cost. We recognize that there likely will be increased demand for technical assistance as a result of the TMDL program, but have not estimated the cost attributable to additional technical assistance that other agencies may provide for TMDL development.

Although states have the primary responsibility for administering the TMDL program, EPA is responsible for providing technical assistance and funding to the states for this work. In addition, EPA provides for the overall management of the program, including review and

---

[9]The national total number of miles impaired by pollutants or pollutant-related pollution is 288,274 (267,231 stream miles and 20,643 lake acres converted to stream miles). Given that much of the monitoring effort is expended in getting to and from the monitored sites, we believe mileage is a reasonable rough proxy for monitoring workload in a state -- better than either number of waters or number of TMDLs (causes).

[10]The default value for the typical cost of an FTE in the State Water Quality Management Resource Needs Model is $70,000, including salary, all overhead and administrative expenses.

approval of lists of impaired waters and TMDLs. EPA is also responsible for developing TMDLs in some circumstances.

EPA is presently budgeting almost $22 million annually for the TMDL program. Of this funding, about $9 million is for support of program staff in Headquarters and the ten EPA regional offices. An additional $2.6 million is available for contracts to support TMDL related work. The remaining $10 million is contract funding that is available to the Regions to support the development of TMDLs where EPA is required to develop the TMDLs under a consent agreement or court order or has otherwise agreed to develop a TMDL for a state.

In addition, EPA provides grants to states to implement Clean Water Act programs, including the TMDL program. These grant programs and the amounts that can be available specifically for the TMDL program include:

- **Section 106 Water Program Grants** -- Funding for implementation grants under this core water program increased from $115 million in 2000 to $170 million in FY 2001, with an indication from the Congress that the $55 million increase was associated with the TMDL program.

- **Section 319 Nonpoint Pollution Control Grants –** Funding for implementation of state nonpoint source pollution control programs increased from $200 million in 2000 to $237 million in FY 2001. EPA has provided that states may use up to 20% of this funding (i.e. about $47 million) to develop TMDLs.

- **Planning Funds from State Revolving Loan Funds Grants** -- Under section 604(b)(3) of the Clean Water Act, states may use up to one percent of grant funds (or $100,000, whichever is greater) for planning and related purposes, including development of TMDLs. In FY 2001, the total funding available under this authority was $14 million.

VI. Costs to Pollutant Sources to Implement TMDLs

In a TMDL, some point and/or nonpoint sources will be assigned allowable loads that are less than the loads they currently discharge. These sources will incur some costs to reduce their loads from current levels to the lower levels assigned by the TMDL. It is these costs to reduce loads that we consider to be associated with the TMDL program and that we estimate in this chapter.[11]

Key Assumptions of the Analysis

Several key assumptions serve as a foundation for this analysis.

1) The cost estimates are for measures to control point and nonpoint sources to implement TMDLs for the impaired waters included in the states' 1998 §303(d) lists.

2) For these impaired waters, we count as costs to pollutant sources the additional controls associated with the TMDLs beyond a baseline that includes:

   -- Whatever controls were in place at point and nonpoint sources when the 1998 §303(d) lists were developed; and

   – Assumed compliance with all applicable current technology-based requirements.

Viewed in another way, the analysis estimates the incremental costs to pollutant sources of implementing TMDLs relative to the sources' baseline in 1998, but excluding the costs of whatever amount of this further progress will be achieved through meeting technology-based requirements that were unmet as of 1998.

Several aspects of how we define the baseline and TMDL costs for pollutant sources deserve more explanation:

- When the 1998 lists were developed, many pollutant sources had already implemented control measures or BMPs beyond those required by technology-based standards. Many point sources had implemented advanced treatment measures as required by water quality-based effluent limits (WQBELs) in their NPDES permits. Many nonpoint sources had implemented BMPs voluntarily or because of incentive programs or state requirements. Therefore, a substantial

[11] Note that some of these same costs could be incurred in the absence of a TMDL, including the period between listing and the development of the TMDL, since §301(b)(1)(C) of the Clean Water Act requires water quality-based effluent limits (WQBELs) for NPDES permittees as stringent as necessary to meet water quality standards.

amount of the controls beyond technology-based standards needed in order to attain water quality standards may have already been put in place by the time the 1998 lists were developed, but had not yet resulted in attainment of water quality standards.

- By the same token, additional progress needed to meet water quality standards for the 1998 §303(d)-listed waters has probably occurred since they were listed. Since 1998 or so, many more point sources have installed advanced treatment measures as required by WQBELs and many more nonpoint sources have implemented desirable BMPs. Thus some of the costs we estimate in this report as needed to meet water quality standards have already been spent. We estimate costs to meet water quality standards relative to a circa 1998 baseline; these costs that we estimate are greater than will be necessary if we were to measure them relative to a current 2001 baseline or at the time when the TMDL is developed according to the 10-25 year time frame in the July 2000 rule.

- We do not count as costs associated with TMDLs those costs to pollutant sources that have yet to be incurred to meet existing technology-based standards. Some of the progress needed to meet water quality standards will come as sources meet as-yet-unmet technology-based requirements, most notably the requirements pertaining to storm water, CSOs and SSOs (some of these, because of statutory requirements, are considered existing requirements, even though specific regulations are under development). The costs of meeting these technology-based standards will be substantial, and for many waters these additional control efforts will be critical to attaining water quality standards. However, technology-based requirements and their associated costs are pursuant to sections of the Clean Water Act other than §303 (TMDLs). Dischargers are and will be required to meet these technology-based standards regardless of whether a TMDL is established or not. Consequently, we do not include these baseline costs in our analysis of costs to dischargers associated with the TMDL program.

Costs and Savings That Are Not Estimated

This study attempts comprehensively to estimate the costs that pollutant sources will incur to achieve the load reductions that will likely be required by the eventual TMDLs for waters listed on the States' 1998 303(d) lists. Given this objective, we want to be clear that the study explicitly does not estimate several sorts of costs:

- *Costs for activities other than abating loads from pollutant sources.* We do not estimate the costs that USDA and other agencies might incur in providing information and technical assistance to farmers who need to reduce their loads. However, to the extent that Federal, State or other agencies themselves are the owners of facilities or lands that are pollutant sources (e.g., military bases, Federal forest and range lands), we do estimate these costs .

- *Broader social consequences that might occur as pollutant sources meet TMDL requirements.* We estimate the costs for sources to reduce their loads to meet TMDL requirements, but these actions may have further consequences for society. We have not attempted to describe the social consequences of these actions or to assign monetary values to these changes. For example, higher water and sewer rates as a result of increased costs for POTW treatment may increase the number of households facing high rates and place greater economic stress on these households. In addition, increased production costs for farmers implementing agricultural BMPs will likely result in reduced agricultural output and/or higher agricultural commodity prices. We also do not estimate the distributional impacts of the costs to pollutant sources. If pollutant sources are particularly concentrated geographically, there may be local or regional consequences. On the other hand, farming economies in other areas not affected by TMDLs may see increased activity triggered by reduced production in the areas affected by TMDLs and resulting higher commodity prices. These sorts of secondary and ultimate impacts cannot be assessed without broad economic modeling of the sectors within which the TMDL-affected pollutant sources operate. This sort of modeling is beyond the scope of this analysis. However, we expect that these broader consequences of TMDL costs will be a small fractional increase in the current costs of the activities the pollutant sources conduct.

- *Costs for pollutant sources affecting waters found in the future to need TMDLs.* This analysis addresses costs relating to currently impaired waters on States' 1998 303(d) lists. More waters may be listed in the future as needing TMDLs. On the other side of the coin, some of the currently listed 303(d) waters will eventually achieve standards or otherwise removed from the list of impaired waters without needing a TMDL. While we did, above, estimate the potential costs to develop future TMDLs, because we have no basis for projecting where these as-yet-unlisted waters will be found and which pollutant sources might need to be addressed because of them, we were unable to estimate implementation costs beyond those for waters listed in 1998.

Other sorts of costs are omitted from this analysis not because we define them as outside of our analytical scope, but because we have been unsuccessful in finding a way to estimate them within the time and data constraints for this study. The major sorts of costs that we have omitted because of analytical resource limitations include:

- *Costs for achieving load reductions from several difficult-to-analyze nonpoint source types.* We estimate the costs for TMDL-prompted load reductions from agriculture, confined livestock, silviculture and on-site wastewater treatment systems (septic tanks, etc.). Likely important but omitted nonpoint source types include resource extraction (mines and oil and gas development), atmospheric deposition, contaminated in-stream sediments, natural sources (e.g., salt springs, natural mineral deposits) and land disposal (both formal and informal sites). We estimate that these omitted source types account for about 14 % of all 303(d) river

miles and 22% of all 303(d) lake acres. Some of these omitted source types can entail high costs for mitigation (e.g., some instances involving dredging and disposing of contaminated in-stream sediments). On the other hand, if impairment from one of these source types cannot be remedied or will involve "widespread social and economic impacts", then the water quality standard giving rise to the TMDL may be revised through a use attainability analysis.

- *Costs for achieving any needed load reductions from point sources covered by general permits.* Our analysis of TMDL-related costs for point source dischargers covers all point sources for which individual NPDES permits have been issued. However, there are potentially 385,000 sources to be covered by stormwater general permits and approximately 52,000 point sources that are covered by non-stormwater NPDES general permits. We believe that TMDLs will rarely require further load reductions from point sources that are currently covered by general permits, and that our omission of these sources from the cost analysis results in only modestly underestimating costs.

In the same light, implementation of TMDLs will result, in some cases, in savings to pollutant sources, for example:

- *Savings due to implementation of some nonpoint source BMPs.* In some cases, BMPs anticipated to be adopted by nonpoint sources in order to meet load reduction targets may yield savings that partly or perhaps even largely offset the costs of the BMPs. For example, we expect that nutrient management planning -- minimizing nutrient losses by more carefully matching the timing and amount of nutrient applications to exactly what is needed by crops -- will be widely adopted by farmers in response to TMDLs seeking reductions in nutrient loads. Nutrient management planning will cost farmers money (in developing the plans, in testing soils, etc.), but it will also yield savings in terms of reduced costs for purchased commercial fertilizers. It is exceedingly difficult to project what these sorts of savings might amount to if these BMPs were applied on a widespread basis, as we simulate in this analysis.

In view of the very large uncertainties in estimating the national savings that might result from widespread implementation of TMDL-prompted BMPs, we decided to treat the potential savings from the BMPs in a different manner from the costs. We explicitly estimate the costs of the BMPs and display them as our estimate of TMDL implementation costs. We also develop some very rough quantified estimates of the potential cost savings from the BMPs, but, -- in an effort both to be conservative and to recognize the much greater uncertainty of the savings estimates -- we choose not to display these savings estimates or to net them out in the tables summarizing TMDL implementation costs.

This decision not to display the savings estimates does not mean that we believe them to be unimportant or nonexistent. To the contrary, we believe that in many circumstances these BMPs will engender substantial savings that offset some portion of the BMP costs. We are

unable, however, to estimate these savings with much confidence. For the final version of this analysis, we intend to gather additional data that will allow us to narrow the range of uncertainty in our national savings estimates.

Methodology – Three Scenarios

Subject to these definitions about what costs are included in the baseline and what costs we attribute to TMDLs, EPA estimated the costs to pollutant sources for the impaired waters on the states' 1998 §303(d) lists under each of three broad scenarios:

-- a "Least Flexible TMDL Program" scenario;
-- a "Moderately Cost-effective TMDL Program" scenario; and
-- a "More Cost-Effective TMDL Program" scenario.

The results of the analysis are summarized in this report. Full details on the analysis are provided in a supporting companion report: *The National Costs to Implement TMDLs*.

The "Least Flexible TMDL Program" Scenario

This scenario explores what costs would result if states chose to respond to the 1998 list of impaired waters by uniformly increasing controls on all sources, point and nonpoint, that contribute the impairment pollutant to the listed water. Rather than allocating loads to the most significant sources or those sources that can most efficiently reduce loads, under this scenario all sources must adopt additional controls. This scenario, while unlikely because of the high probability that it will over-control sources and impose unreasonable costs, in effect represents continuing to implement the water quality-based approaches that have been used when a TMDL has not been developed. For example, under Clean Water Act §301(b)(1)(C), all NPDES permits for point source dischargers must include limits necessary to meet water quality standards. Similarly, under §319 of the Act, states must address the nonpoint sources that contribute to impairment of water bodies (though not necessarily through regulatory mechanisms, as are mandated for point sources through the NPDES program).[12] Under this scenario, these controls

---

[12] Some observers have postulated a different scenario in the absence of TMDLs. These observers emphasize that point sources are subject to regulatory controls under the NPDES program, while nonpoint sources are generally not subject to federal regulatory controls. If achieving water quality standards were to depend solely on federal regulatory authorities available under the Clean Water Act, states or EPA would be able to require further control efforts only from point sources. NPDES permit limits for point sources would be progressively tightened as necessary to make up for uncontrolled nonpoint sources. Under this "point source only worst-case scenario," many point sources would ultimately need to meet exceedingly costly "zero discharge" limits in an attempt to compensate for growing nonpoint source loads.

We regard this scenario as extremely unrealistic and will not analyze it. For many impaired water bodies, the contribution from point sources is minimal or non-existent. Any realistic program to achieve water quality standards in all impaired waters must seriously address nonpoint sources as well as point sources.

would be implemented uniformly and without flexibility to all sources that contribute to impairments.

Our Methodology for Estimating Costs to Pollutant Sources – the "Least Flexible TMDL Program" Scenario

We follow three steps:

1. Identify all the point and nonpoint sources in the nation that appear to contribute an impairment pollutant to one of the impaired waters on the 1998 §303(d) lists.

2. Assume that every such relevant source will be required under the NPDES program or somehow induced under the 319 program to implement additional measures (beyond those assumed to be in place already to meet existing technology-based standards) to abate this pollution.

3. Estimate the costs for each source to implement an appropriate "next treatment step" that will presumably sufficiently reduce the source's discharge.

The "Moderately Cost-effective TMDL Program" Scenario

The "Moderately Cost-effective TMDL Program" scenario differs from the first scenario in that it assumes the use of a more careful TMDL process, including non-uniform and flexible allocation among sources to achieve cost effective reductions. This begins with an assessment of the impaired water body and all the sources that affect it. Then the "moderately cost-effective TMDL" determines how much load from all the sources together can be tolerated, and allocates this allowable load in some manner among the responsible sources.

In the least flexible scenario, every source that discharges the impairment pollutant will presumably need to implement measures to abate its discharge. With a "moderately cost-effective TMDL," a much finer calculation is made. The TMDL determines exactly which sources will need to reduce their loads, and by how much. Depending on the severity of the impairment, with a moderately cost-effective TMDL, somewhere between a few and many of the sources discharging the impairment pollutant may not have to reduce their discharge at all. By addressing each source in isolation and requiring further controls from all of them individually, the previous "Least Flexible TMDL Program" scenario is likely to greatly overshoot the load reduction needed to attain water quality standards. Under this scenario, which describes EPA's assumption of how TMDLs will normally be developed and implemented, the number of sources that have to reduce their loads should, in most cases, be reduced.

Our Methodology for Estimating Costs to Pollutant Sources – the "Moderately Cost-effective TMDL Program" Scenario

We start with the steps for the "Least Flexible TMDL Program" scenario: a) Identify all sources responsible for impairments; 2) Estimate costs for all of them to implement an appropriate "next treatment step". We then:

- Scale these costs down to reflect the average percentage load reduction identified in typical TMDLs relative to the load reduction that would be obtained if all sources were to implement the "next treatment step".

The "More Cost-Effective TMDL Program" Scenario

Neither the Clean Water Act nor EPA's implementing regulations prescribe how a total maximum daily load is to be allocated among the sources that discharge the impairment pollutant. The state may assign responsibilities among sources for load reductions as the state wishes. Different allocations will result in different total costs of achieving the desired total load reduction, as a function of the differing costs per pound for the various sources to reduce their loads.

In general, the total costs of achieving the target load reduction will be lower if the sources with lower per unit control costs are assigned responsibility for achieving the bulk of the desired total load reduction. We use the term "more cost-effective wasteload allocation" to denote a situation in which the state attempts to reduce aggregate costs by assigning responsibility for achieving most of the total desired load reduction to sources that have relatively low costs of achieving load reductions. Alternatively, the same economically efficient result (achieving a desired total load reduction in the least-cost manner) can be achieved, in theory, given any initial allocation of control responsibilities, if "trading" is allowed after the allocation and permit limits are set by the TMDL. With trading, any source that is assigned responsibility for a load reduction is free to achieve that load reduction itself, or to buy the equivalent load reduction from another source that might be able to provide it at lesser cost. Whatever the initial allocation, trading could elicit load reductions from the lowest cost sources.

The "More Cost-Effective TMDL Program" scenario recognizes the possibility of reducing TMDL costs to point source dischargers through either additional "cost-effective wasteload allocations" or through trading, or both. Either of these approaches would reduce the eventual costs to dischargers well below what they would be if TMDLs assigned load reductions on a cost-neutral basis (e.g., if load reductions were determined on a simple proportional rollback basis). We expect that pressure to adopt cost-minimizing approaches will build, and more TMDLs will tend toward this "more cost-effective" model. Note, though, that there may be some instances where other concerns (e.g., equity or concern about implementation and enforcement complexities attendant to trading) prevent use of these cost-minimizing approaches.

Our Methodology for Estimating Costs to Pollutant Sources – the "More Cost-Effective TMDL Program" Scenario

We start by estimating the costs for the "Reasonable TMDL Program". We then:

- Scale these costs down to reflect the typical percentage cost savings that might be realized through additional "cost-effective wasteload allocations" or trading.

In projecting what future TMDLs are likely to require for the impaired water bodies, we based several key assumptions on our findings from reviewing the content of a sample of fifteen recently completed TMDLs. This review is summarized in *National Costs to Implement TMDLs,* Appendix A -- "Ground-Truthing the Implementation Cost Analysis Assumptions." This sample of fifteen is smaller than we would like, and it will be increased for the final version of this report. The major findings from this review are:

- TMDLs commonly, but not always, address upstream point sources in addition to those point sources discharging the impairment pollutant directly into the impaired water;

- The aggregate load reduction needed from point sources is often obtained without requiring further controls from all of the point sources discharging the impairment pollutant;

- The geographic extent of nonpoint sources from which further controls are required is typically much less than the entire county(s) surrounding the impaired water;

- For both point and nonpoint sources, the degree of load reduction that is required is very often less than that which would be achieved if all point and nonpoint sources were to implement "the next treatment step".

More specifically, in estimating the costs of the "Moderately Cost-effective TMDL Program" and "More Cost- Effective TMDL Program" scenarios, we drew the following quantitative relationships from the sample of the fifteen TMDLs:

- For point sources. In about half the TMDLs, the aggregate load reduction actually required of point sources was roughly equivalent to what would be achieved if all point sources contributing to impairment of the water body were to implement the "next treatment step". In the other half of the TMDLs, "the next treatment step" for all point sources would result in about twice as much aggregate load reduction as was actually needed.

- For nonpoint sources. The size of the watershed from which most TMDLs required nonpoint source load reductions was far smaller than the size of a typical county. The acreage of most nonpoint source TMDL watersheds ranged from about 5 % to about 40 % as large as the acreage of the county(s) within which the impaired water body was located.

These quantitative relationships should be regarded as tentative pending the evaluation of more completed TMDLs.[13]

---

[13]Note that we are not presuming to use this small sample of 15 cases as a basis for projecting the national costs of TMDLs. We have not estimated implementation costs for sources in each of the 15 cases and then extrapolated or scaled up from these cases to the nation as a whole. Instead, we adopted the approach described here of estimating the implementation costs for all of the impaired water bodies in the nation by employing a series of simplifying assumptions about what all TMDLs will require of relevant sources. Under this approach, we use the 15 case studies not as the fundamental basis from which to extrapolate, but instead in a more limited way to shed light on the reasonableness of our assumptions. The case studies suggest that actual TMDLs only very rarely require load reductions as large as those presumed under our Scenario 1 (all relevant point sources implement the next treatment step, and all relevant nonpoint sources in the entire county implement the next treatment step). The case studies thus suggest that Scenario 1 really is something like a worst case. The case studies also suggest what

Estimated Pollution Control Costs for Pollutant Sources Under the Three Scenarios

For each of the three scenarios, we estimate the costs for controlling the point and nonpoint sources that affect each of the currently listed §303(d) waters. These cost estimates are for the incremental controls -- relative to those that existed in 1998 or so when the impaired waters were listed -- that will be needed. To the extent that some of these costs have already been incurred since the waters were listed, the cost estimates we present here overstate the costs that remain for dischargers.

The task of projecting the costs for pollutant sources stemming from efforts to implement TMDLs for nearly 20,000 impaired waters is particularly difficult because the actual TMDLs or water quality-based requirements have been established for only a very few of these waters. We do not know, at this point, how far out of attainment most of the impaired waters will be found to be, what sources will be found to be responsible for each impairment, and what degree of load reduction will be required of each responsible source. In this analysis we must estimate each of these elements now, before the actual TMDLs or water quality studies have been developed. Our analysis necessarily involves many assumptions that we apply to the relatively limited data that now exists on these impaired waters and the sources that may contribute to their impairment. Thus, our cost estimates are subject to substantial uncertainty. Our data, methodology and assumptions are described in detail in the supporting cost analysis.

We estimate the costs to pollutant sources in first quarter 2000 dollars. All costs include capital and operating and maintenance costs, combined into a single annualized cost figure. The cost estimates that we present represent annualized amounts beginning in the year 2000 that will continue each year, forever. TMDLs are assumed to be developed at an even pace over the 15 years from now through 2015, consistent with the deadline for TMDL development established by the new regulations. The average source is assumed to begin incurring its costs to implement TMDL allocations five years after the TMDL affecting that source is developed. The timing of compliance investments by sources is assumed to be identical under each of the three TMDL scenarios. A real discount rate of 7 % is used.

---

some assumptions more typical of most TMDLs might be. We use some rough averages drawn from the case studies in defining our more cost-effective Scenarios 2 and 3.

EPA recognizes that the 15 case studies are not representative of all conditions that may be found in potential TMDLs. For instance, none of the 15 represents a water body impaired by agricultural chemicals or sediment in a major crop producing area. We believe this is acceptable because we do not use the case studies in a manner such that this sort of representativeness is critical. We use the case studies primarily to elucidate several much broader questions: Is Scenario 1 really something like a worst case? For a moderately cost-effective Scenario 2, how much less should we assume than "the next treatment step will be implemented by all relevant point sources within a relevant distance and all relevant nonpoint sources in the entire county? For questions of this greater level of generality, we believe that our sample of 15 is reasonably representative. Nevertheless, we agree that the sample to be used for "groundtruthing" our assumptions should be expanded, and we will do so for the final version of this report.

Under a uniform, inflexible TMDL approach, (the "Least Flexible TMDL Program" scenario) pollutant sources will incur costs estimated at $1.9 - $4.3 billion per year to implement controls for the nearly 20,000 impaired waters for which TMDLs will be developed. In the absence of a more detailed assessment of the required load reductions, a state might chose to require further controls from all sources that discharge the impairment pollutant. This is equivalent to approximately $95,000 - $215,000 annually in implementation costs per listed water body.

In contrast, to meet the same objective of reducing loads below the maximum amount in the same time frame, under the "Moderately Cost-effective TMDL Program" scenario, pollutant sources will need to spend only $1.0 - $3.4 billion per year. This is a cost reduction of 21 - 44 %.[14] The savings reflected in the "Moderately Cost-effective TMDL Program" scenario are due to more careful calculations to determine the load reduction that are deemed sufficient to achieve water quality standards rather than uniformly requiring controls and thereby exceeding necessary reductions.

Under the "More Cost-Effective TMDL Program" scenario, costs to dischargers may decline by roughly 7 to 13 % ($140 - $235 million annually) from those that would occur under the "Moderately Cost-effective TMDL Program" scenario. Rather than requiring equivalent control efforts from all pollutant sources from which further controls will be sought, the state would strive to achieve efficient allocations based on the relative costs for the different sources to reduce pollution. These savings that we estimate from more cost-effective waste load allocations represent only the savings available from shifting some point source control responsibilities to nonpoint sources (i.e., "point/nonpoint trading"). We have not been able to estimate but assume there could be additional savings that might occur from other sorts of cost-effective allocations (e.g., "point/point" trading, "nonpoint/nonpoint" trading, pretreatment trading).

[14]The scaling is based on a review of 15 completed TMDLs selected to cover a substantial range of impairment pollutants, source types (both point and nonpoint sources) and geographic locations. Given the wide variation in the sorts of waters and impairments that actual TMDLs will address, a sample of 15 completed TMDLs is obviously far short of an ideal data base from which to draw conclusions and some regions are under represented. Nevertheless, this initial groundtruthing effort provides some preliminary indications of patterns across actual TMDLs. See *The National Costs to Implement TMDLs*, Appendix A for more details.

Table VI - 1
Estimated Costs for Pollutant Sources to Implement TMDLs

Type of Source	Annual Costs (2000 $ in millions)		
	Least Flexible TMDL Program	**Moderately Cost-effective TMDL Program**	**More Cost-Effective TMDL Program**
Point sources	1,082 - 2,178	812 - 1,634	625 - 1,321
Nonpoint sources	783 - 2,162	234 - 1,791	281 - 1,869
Total implementation costs	**1,865 - 4,340**	**1,046 - 3,425**	**906 - 3,190**
Potential savings for nonpoint sources	undetermined	undetermined	undetermined

Point Source Implementation Costs

Under the first two scenarios, half or more of the costs will be incurred by point sources. This is despite the fact that point sources affect only about 1/4 of the impaired waters while nonpoint sources affect more than 90 %. Under the third scenario, some point source control responsibilities are presumed to be shifted to nonpoint sources because of the expected ability of nonpoint sources to abate loads at lower costs per pound. Even so, point sources may still incur the majority of the implementation costs.

Table VI - 2
Estimated Costs for Point Sources -- Least Flexible TMDL Program

Type of Source	Annual Costs (2000 $ in millions)		Number of Affected Facilities	
	Low Est.	**High Est.**	**Low Est.**	**High Est.**
Industrial dischargers	676	1,465	3052	8557
Indirect dischargers (metals)	10	16	at 148 POTWs	at 312 POTWs
POTWs	396	697	1094	3335
Total	**1,082**	**2,178**	**4,146**	**11,893**

Table VI - 3
Estimated Costs for Point Sources for
"Moderately Cost-effective TMDL Program" and "More Cost-Effective TMDL Program Scenarios"

Type of Source	Annual Costs (2000 $ in millions)		Number of Affected Facilities	
	Low Est.	High Est.	Low Est.	High Est.
Industrial dischargers	507	1,099	2289	6418
Indirect dischargers (metals)	8	12	at 111 POTWs	at 234 POTWs
POTWs	297	523	821	2502
Total	**812**	**1,634**	**3,110**	**8,919**
Potential savings from "More Cost-effective TMDL Program," Scenario 3 (savings in parentheses)	**(187)**	**(313)**	**1,251**	**2,066**

The low and the high estimates shown above reflect differing judgments about how far upstream of an impaired water typically can there be point sources that contribute to the water body's impairment. The lower estimate assumes that only point sources discharging the impairment pollutant directly into the listed water contribute to impairment. The upper estimate assumes that point sources can contribute to impairment from as far away as 25 miles upstream (if the impairment pollutant is BOD, ammonia or toxic organic chemicals) or 50 miles upstream (if the impairment pollutant is nutrients or metals). We believe these two estimates provide reasonable lower and upper estimates for the geographic extent of point sources that will be judged as relevant in TMDLs.

There are roughly 70,000 individually permitted point source dischargers in the nation. Thus, somewhere between 6 and 17 percent of them seem likely to be affected if there were no flexibility under the TMDL program, as described in the "Least Flexible TMDL Program" scenario. Based on the experience from a sample of recently developed TMDLs, only about 3/4 of these sources (about 3,000 - 9,000 dischargers) will likely incur costs under the "Moderately Cost-effective TMDL Program" scenario. Of these point sources likely to be affected by the "Moderately Cost-effective TMDL Program" scenario, perhaps 20 to 40 percent of them will incur no or reduced costs if the TMDL program proceeds to allocate control responsibilities in a more cost-effective manner ("More Cost-effective Scenario").

Nonpoint Source Implementation Costs

Costs were estimated for four types of nonpoint sources: agricultural land (including crop, pasture and range land), animal feeding operations (AFOs), silviculture, and on-site wastewater treatment systems (septic tanks, etc.). Table VI-4 shows the costs from the management measures that may be implemented by the four types of nonpoint sources that we analyze.

Table VI - 4
Total Implementation Costs for Nonpoint Sources

Type	Scenario 1 Worst-Case TMDL Program	Scenario 2 Moderately Cost-effective TMDL Program
Agricultural land crop land pasture land range land *Potential savings*	 645 - 1,956 5 - 11 2 - 16 *(not estimated)*	 183 - 1,632 5 - 11 2 - 16 *(not estimated)*
AFOs *Potential savings*	76 - 110 *(not estimated)*	13 - 73 *(not estimated)*
Silviculture	30 - 42	7 - 31
On-site wastewater treatment systems	24 - 28	24 - 28
Total ***Potential Savings***	**782 - 2,162** ***(not estimated)***	**234 - 1,733** ***(not estimated)***
ADDITIONAL COSTS TO NONPOINT SOURCES UNDER SCENARIO 3 ("MORE COST-EFFECTIVE TMDL PROGRAM")	**47 - 78**	

Many sources of unit cost information are used in estimating the cost of implementing these nonpoint source BMPs as a function of the volume and characteristics of the nonpoint sources. The costing relationships and the underlying sources are described fully in the supporting report, *The National Costs to Implement TMDLs*, Appendix I.

In estimating implementation costs for nonpoint sources, unit costs and cost savings for projected BMPs were applied to the volume of nonpoint source activity assumed to need further controls as estimated for each of the TMDL program scenarios. To the extent that some portion of the nonpoint sources have already implemented some of the BMPs, the implementation cost and savings estimates were reduced to reflect the practices that are already in place.

APPENDICES: Other Issues Raised In House Report #106-988

Responses to Issues Raised by General Accounting Office

Estimate of Costs to Small Businesses

Summary of comments on Draft Report

APPENDICES: Other Matters of Interest to Congress

1. Responses to Issues Raised by the General Accounting Office

The U.S. General Accounting Office issued a report[15] raising a number of issues regarding the proposed revisions to the TMDL regulation. The following addresses the major issues regarding the July 2000 regulation that were not already covered in the body of this Report.

Assumption of Full Compliance

The GAO report that EPA analyzed the incremental impact of the regulation, but not the full cost of compliance with the long-established TMDL program requirements. This report and its supporting cost analyses[16] estimate the full cost of the TMDL program to states and to pollutant sources.

Limitations of Water Quality Data

GAO noted that much of the Nation's waters have not been assessed, and that while EPA's economic analysis of the TMDL proposal acknowledged that additional waters needing TMDLs will undoubtedly be identified in the future, "EPA did not estimate costs for developing TMDLs for these waters." The supporting report, *The National Costs to Develop TMDLs*, does address this issue which we also address below.

This following provides perspective on the total number of new causes that might be identified in the future, the rate at which these new causes might be listed, and the resulting distribution of this workload over time. While this discussion is necessarily speculative, it does provide an indication of the additional workload, its timing and potential cost.

Perspective on the total number of new causes that might be added in the future

To date, states have monitored or assessed only a portion of their water bodies. In the future, there will likely be new listings each cycle (e.g., 2002, 2006, 2010, 2014, 2018). These new listings might identify the need to develop additional TMDLs beyond those identified in the

---

[15]U.S. General Accounting Office, *Proposed Revisions to EPA Regulations to Clean Up Polluted Waters*, GAO/T-RCED-00-233, June 28, 2000

[16]Environomics and Tetra Tech, Inc., *The National Costs to Develop TMDLs*, prepared for the U.S. EPA, Office of Wetlands, Oceans and Watersheds, draft May 2001 and

Environomics and Tetra Tech, Inc., *The National Costs to Implement TMDLs*, prepared for the U.S. EPA, Office of Wetlands, Oceans and Watersheds, draft May 2001

1998 §303(d) listing. Based on the National Water Quality Inventory (NWQI) Report for Congress for 1998,

- 23% of the Nation's river and stream miles have been assessed; 35% of these do not fully support water quality standards or uses and an additional 10% are threatened.

- 32% of the estuary acres have been assessed; 44% of these do not fully support water quality standards or uses and an additional 9% are threatened.

- 42% of lake, pond and reservoir acres (not including the Great Lakes) have been assessed; 45% of these do not fully support water quality standards or uses and an additional 9% are threatened.

- 90% of the Great Lakes shoreline miles have been assessed, and 96% of the shoreline miles are not fully supporting water quality standards and uses, and an additional 2% are threatened.

Thus, about 1/3 of the Nation's waters have been assessed in 1998, leaving 2/3 to be assessed. Earlier NWQI reports include assessments of some different as well as many of the same waters. States have the flexibility to assess whatever waters they wish although EPA has been encouraging them to rotate among all waters on a five year basis. In addition, other data sources, such as USGS, can provide data on some of the unassessed waters.

As assessment and monitoring efforts expand to cover more of the Nation's water bodies, more impaired water bodies needing TMDLs will likely be found. A portion of the causes for the impaired water bodies that will be identified in the future will have TMDLs developed for them. In addition, a portion of the water bodies that have already been assessed and are not currently impaired may be found to be impaired in the future (perhaps a portion of the currently "threatened" water bodies).

However, the magnitude of the water quality problems yet to be discovered is likely to be far less than might be suggested by only cursory consideration of the above statistics, for three reasons:

- ***Many of the unassessed water bodies are extremely unlikely to be impaired.*** For example, a significant fraction of the unassessed water bodies are located in areas that for the most part are considered to be pristine (for example, Alaska alone represents over 10% of the unassessed river miles and about half of the unassessed lake acres.) In addition, the reported total river miles doubled from the 1992 to the 1996 305(b) lists to include nonperennial water bodies (intermittent streams, canals and ditches), which are generally unlikely to be considered impaired and these comprise over 75% of the unassessed river miles.

- ***State monitoring efforts have been focused on water bodies most likely to be impaired.*** Therefore, it is likely that most major water quality problems have already been identified. This is consistent with the results of a recent report by the General Accounting Office, in which "the state officials we interviewed said they feel confident that they have identified most of their serious water quality problems.[17] This suggests that the rate of impairment for unassessed waters will be far lower than for assessed waters.

- ***Future impairment of currently assessed waters is not likely to be significant.*** If all threatened waters became impaired, then this might increase the current number of TMDLs by perhaps 20%-30%. However, only a portion of these might actually become impaired because current programs, such as technology-based requirements, and steps taken be states to address threatened water bodies can potentially prevent a significant portion of threatened water bodies from becoming impaired.

Overall, it is anticipated that although additional impaired water bodies will be identified in future listings, it does not appear likely that this will result in a significant increase relative to the current workload for the 1998 §303(d) lists.

Perspective on the rate at which new causes might be identified in the future

There is little basis for forecasting the rate at which additional impairments will be identified in future listings. From 1972 to 1992, very few states submitted §303(d) lists. By 1996, in response to law suits and increased effort by EPA, all of the 56 states had submitted lists, although these varied in their comprehensiveness. In 1998, in response to the growing number of law suits, most of the 56 states did a thorough job of listing their impaired water bodies. The increase in the number of pollutant causes in the 1998 §303(d) list as compared to the 1996 §303(d) list was 4,536 causes. The 1998 lists grew significantly in some states because authorities wanted to minimize the potential for litigation and listed causes for which TMDLs would ultimately not be required (some states are planning on submitting additional information in future listings that will allow them to de-list causes that were previously identified in the 1996 or 1998 listings). The increase of 4,536 causes from the 1996 to the 1998 §303(d) lists (about 2,000 causes per year) thus likely overstates the extent to which new pollutant causes will be identified in future listings. In fact, if states do delist TMDLs in the future, some future listings may actually reduce the TMDL workload rather than increase it.

Further, current state monitoring resources are largely committed for water bodies that have already been assessed and identified as impaired, as well as other monitoring requirements associated with ongoing water program activities. Until the TMDLs for the 1998 §303(d) lists are developed, implemented and successful in achieving water quality standards, it seems likely

[17]U.S. General Accounting Office, *Identification and Remediation of Polluted Waters Impeded by Data Gaps*, GAO/T-RCED-00-131, page 4, March 2000.

that there will be limited discretionary monitoring resources available for states to assess additional water bodies. Even then, newly identified impaired water bodies could also require additional monitoring. Thus, the workload associated with newly identified impaired water bodies is likely to be spread out over a long period.

Finally, EPA anticipates that new causes will be identified gradually over an extended period of time, in part because states have already focused on those areas most likely to be impaired and so it will take longer to find new impairments, and in part because some water bodies may not become impaired until some time in the future (for example, water bodies that are currently "threatened" but not impaired).

Hypothetical scenario for perspective on the potential workload for new causes

In this report, we provide some perspective on the potential workload associated with new causes that will be identified in the future. To do so, we estimate the cost for a plausible, but hypothetical, scenario based on the following assumptions regarding 1) the rate at which new pollutant causes will be identified, 2) the period over which new causes will be identified, 3) the rate at which TMDLs will be developed for these causes, 4) the characteristics of the TMDLs that will need to be developed, and 5) the unit costs for developing TMDLs:

- On average, we assume that 1,000 new pollutant causes might be identified in each future listing. However, since a number of states appear to be preparing to de-list causes, we assume that there will not be a net increase in the number of causes in the 2002 listing, and that net new causes will be added starting in the 2006 listing.

- We assume that 1,000 new pollutant causes will be identified for perhaps nine listings, with few remaining causes to be identified after 2038, for a total of 9,000 new causes, which is equivalent to about 25% of the current TMDL development workload for the 1998 §303(d) lists.

- We assume that the TMDLs for newly identified causes will be developed uniformly over a 10-year period from being listed. – for 1,000 newly listed causes this would result in 100 TMDLs per year. With the last set of new causes listed in 2038 and this pace of development, the TMDLs for all of the future causes would be developed by 2050.

- We assume that the characteristics of the TMDLs for future causes will be similar to causes already identified, and that by the time these TMDLs are developed it will be possible to do employ the most efficient approaches.

- We assume that the unit costs to develop TMDLs for newly identified causes will be the same as for the 1998 §303(d) lists – this assumption tends to overstate costs because we anticipate that with the experience of developing TMDLs for the 1998 §303(d) lists, state staff will be increasingly more effective and efficient, and that new methods and technology will become available to further lower TMDL

development costs. However, we did not attempt in this report to estimate the extent to which such cost savings would occur, and so relied upon the conservative assumption that the unit costs for TMDL development would remain constant in real terms.

This scenario represents a total of 9,000 TMDLs or about 25% of the current workload for the 1998 §303(d) lists.

Potential Cost

The above plausible, hypothetical scenario provides perspective on the potential workload that might be associated with new pollutant causes that are identified in future listings. For this scenario, a total of 9,000 TMDLs would be developed at a total undiscounted cost of $216 million at a typical undiscounted yearly cost of about $5-7 million[18] over most of the period through 2050. Additional detail is provided in *The National Costs to Develop TMDLs*.

If the total number of new causes, the pace of identifying them, the difficulty of developing TMDLs for them, the pace of TMDL development, and the characteristics of the new TMDLs differs from this hypothetical workload, then these costs will increase or decrease accordingly.

Other Limitations

The GAO report noted several additional issues, some of which were addressed in the body of this report and some of which we address below.

- Unverified Data. The GAO report emphasized the need to verify estimates. *The National Costs to Develop TMDLs* provides extensive analyses to verify the estimates in the report.

- Costs to the Private Sector The costs to the private sector were estimated in the supporting report *The National Costs to Implement TMDLs*, and was summarized in this Report as well.

- Accounting for Uncertainty The GAO report emphasized the need for sensitivity analysis given the uncertainty of some estimates. *The National Costs to Develop TMDLs* provides ranges for key assumptions, and indicates the extent to which the results may vary depending on the accuracy of the assumptions.

- Analysis of Benefits. The GAO report emphasized the need to address the benefits of the program, which we addressed in the body of this Report.

[18]Since the workload for different listing periods would overlap (due to a four-year listing cycle and a ten-year period to develop the TMDLs), the overall pace of development would start at 100 TMDLs per year, working up to about 200-300 TMDLs per year and stay at that rate for most of the period, and then wind down.

- Costs to Other Federal Agencies. GAO noted that EPA did not include the costs to other federal agencies that might result due to the regulation. However, the July 2000 regulation was substantially revised from the initial proposal and there is no additional burden to other Agencies. However, EPA has not estimated the burden on other federal Agencies for the overall TMDL program.

2. Estimate of Costs to Small Businesses

While the proposed regulation for the National Pollutant Discharge Elimination System (NPDES) Program would have resulted in additional costs to small businesses, the July 2000 regulation revising the TMDL and the NPDES programs do not result in additional costs to businesses.

3. Summary Comments on Draft Report

To be added after close of comment period